

The Deep Space 1 and Space Technology 4/Challengenger Missions

Paul R. Weissman (Jet Propulsion Laboratory/Caltech)

NASA's New Millennium Program (NMP) is designed to develop, test, and flight validate new, advanced technologies for planetary and Earth exploration missions, using a series of low cost spacecraft. Two of NMP's current missions include encounters with comets and asteroids. The Deep Space 1 mission was launched on October 24, 1998 and will fly by asteroid 1992 KD on July 29, 1999, and possibly Comet Wilson-Harrington and/or Comet Borrelly in 2001. The Space Technology 4/Challengenger mission will be launched in April, 2003 and will rendezvous with, orbit and land on periodic Comet Tempel 1 in 2006. ST-4/Challengenger is a joint project with CNES, the French space agency.

The DS-1 mission is going well since launch and has already validated several major technologies, including solar electric propulsion (SEP), solar concentrator arrays, a small deep space transponder, and autonomous navigation. The spacecraft carries two scientific instruments: MICAS, a combined visible camera and UV and IR spectrometers, and PEPE, an ion and electron spectrometer. Testing of the science instruments is ongoing. Following the asteroid encounter in July, 1999, DS-1 will go on to encounters with one or both comets if NASA approves funding for an extended mission.

The ST-4/Challengenger mission will use an advanced, multi-engine SEP system to effect a rendezvous with Comet P/Tempel 1 in February, 2006, after a flight time of 2.8 years. After orbiting the comet for several months in order to map its surface and determine its gravity field, ST-4/Challengenger will descend to the comet's surface and will anchor itself with a 3-meter long harpoon. Scientific experiments include narrow and wide angle cameras for orbital mapping, panoramic and near-field cameras for landing site mapping, a gas chromatograph/mass spectrometer, a combined microscope and infrared spectrometer, and physical properties probes. Cometary samples will be obtained from depths up to 1.4 meters. The spacecraft is solar powered with rechargeable batteries, thus allowing a long duration mission on the nucleus surface. At the time of this writing, the ST-4/Challengenger spacecraft was undergoing a major redesign to fit within NASA cost constraints, and approval of the mission is pending.